

# Sensors and Sensing Systems for Water Quality Monitoring

Ravi Selvaganapathy, Dawn Martin-Hill, Chang-qing Xu, Jamal Deen, Charles deLannoy, Emil Sekerenski, Peter Kruse, Juewen Liu, Carolyn Ren, Phillip van Cappellen, James McGreer, Scott Smith, Karsten Liber, Wahid Khan

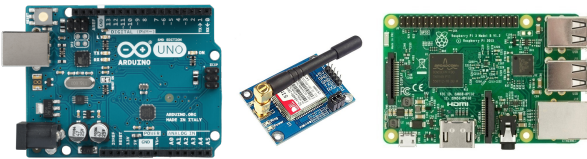
## KEY OBJECTIVES:

- One of GWF key objectives - integrate water quantity and quality data in real-time, make it readily available to users wirelessly.
- Critical need to understand the effect of human activities on the ecosystem and water .
- This involves the use of sensors and sensing systems that can be deployed in the environment to monitor contaminants and their variation over the short and long time scales.

## OVERARCHING GOALS:

- 1) Development of **low-cost sensing systems** for long term monitoring of water quality.
- 2) Development of **specific low cost sensors** and integrate them with the sensing system.

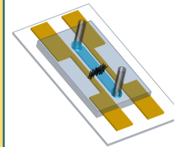
## Low Cost Sensing Systems



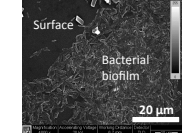
- Commercial, custom built, software-based

## New Sensor Designs

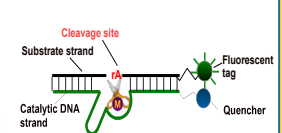
Free chlorine sensor



Biofouling prevention



Aptamer for heavy metals

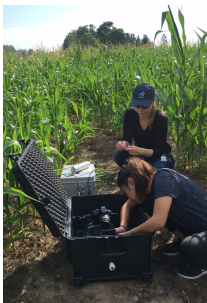


- Analytes: heavy metals, oxidants, nutrients, pathogens

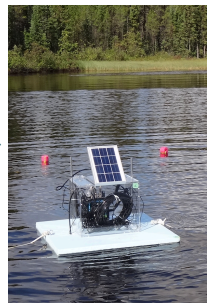
## APPLICATIONS:

- Major challenge in the risk assessment of contaminated waters, whether from agricultural or municipal operations, is the fluctuating nature of contaminant concentrations in those waters.
- **Environmental and agricultural perspectives:** nutrient loads and eutrophication of waterbodies remain serious concerns; can result in cyanobacterial blooms with toxic consequences.
- **Community and drinking water:** measurement level of free chlorine, dissolved oxygen and pathogens present remains an important consideration.

## Environmental and Agricultural



- (Left) Fiber optic sensor for oxygen monitoring installed in soil , agricultural field in Southern Ontario
- (Right) Libelium sensor deployment in lake downstream of mining operation to assess risk of metals on water and invertebrate, in Saskatchewan



## Community and Drinking Water

- (Below) Well water sampling at Six Nations community in Ontario, to measure coliform concentration and physical/chemical water parameters
- Data will be released to community members and compared to historical records; many indigenous communities suffer under long-term water advisories or have a deficit of holistic strategies for water monitoring



## UN SUSTAINABLE DEVELOPMENT GOAL:

- Support and strengthen the participation of local communities in improving water and sanitation management
- Achieve universal, equitable access to safe, affordable drinking water for all
- protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

## CONCLUDING REMARKS:

- Long term field deployment of newly developed sensors and systems to determine lifetime, performance variations, and maintenance protocols.
- Will expand deployment to many more end user groups.
- Optimization and field validation of sensors in Northern Saskatchewan sites and Far North (Iqaluit) community.